



influenza

Is School Closure an Effective Strategy to Control Influenza?

Influenza poses a significant and recurring threat to population health, and it is the job of public health leaders to determine which interventions are most likely to help prevent and control the spread of infection and serious illness.

For several reasons, closing schools seems like a logical approach to managing community outbreaks of influenza. First, school-aged children are among the age groups more susceptible to influenza infection. Second, they tend to shed more of the virus into their environments, increasing the risk of exposure for those around them. Third, they live, learn, and play in close contact with many others – classmates, friends, teachers, family members, and caregivers. As a result, limiting contact among school-aged children should, in theory, reduce the spread and lessen the impact of pandemic or seasonal influenza, both among children and in the broader community.

In practice, however, the effectiveness of school closures for managing outbreaks or severe outcomes related to influenza is unclear. Research on school

closures has sometimes lacked rigour, often led to contradictory findings, or been insufficient to answer some of the more important questions.

Evidence of benefits

Several studies suggest that school closures can help to slow the spread of influenza, particularly among school-aged children. Observational and mathematical modelling studies have found these effects in different jurisdictions and in various outbreak circumstances, as well as during opportunistic and planned closures. In some studies, influenza rates rebounded following re-opening of schools and this “reversal effect” has been interpreted as support for the benefits of school closures. Modelling research has found that closures may not always reduce the total number of cases although peak case counts may be lessened, which suggests that closures are worth considering to offset a short-term surge in demand for health services. Such different research results have raised questions about the lasting benefits of closing schools.

School Closure Definitions

School closure: cancellation of all classes for a period of time when students do not attend school. Closures vary in length but last for at least one full school day.


Reactive school closure: closure of school in response to a number of students or staff being infected and showing symptoms of disease.

Proactive school closure: closure of school before any infection transmission among students or staff occurs or is identified.

Opportunistic school closure: closure of school for reasons un-related to infection, such as during holidays or a teachers’ strike.

Targeted closure: closure of a specific school or all schools in a specific geographic location. The scale of targeted closures varies.





While closing schools may reduce the spread of influenza among students, the community-wide benefits are less certain. Indeed, anecdotal reports suggest that the advantages of school closures for students may be offset by the spread of influenza in the community, as social interactions among children shift from schools to home and community settings. Some modelling research has indicated that community level benefits are more assured if closures are put in place early (prior to the peak of the epidemic) and if closures are of longer duration (i.e. 8 weeks), although the benefits of closures diminish with increasing transmission rates. It appears that what is effective is likely at odds with what is achievable, acceptable or necessary from the perspectives of community members and public health authorities.

Public health officials are less interested in the potential of school closures than they are in answers to the question, 'what does work?' Unfortunately, there is still little consensus on the merits of particular closure strategies. There are not enough systematic and controlled studies comparing triggering thresholds, timing, scale or duration of closures. Additionally, the benefits of closing schools also depend on epidemiological features of an outbreak (e.g. the dominant strain, severity of the strain, susceptible population(s), transmission rate) and characteristics of affected populations (e.g. demographic, socioeconomic, contact patterns). Without more controlled and rigorous study, it remains difficult to generalize findings across populations and outbreaks.

Despite some evidence that closures can reduce influenza transmission,

observational studies are often limited in their ability to isolate the effects of school closure from other interventions. For example, if school closures follow or are paired with immunization campaigns, it is difficult to distinguish between the effects of one intervention and another. Similarly, some studies indicate that school closures are most effective when implemented early, prior to the peak of the epidemic, but as many closures take place relatively late, it is unclear if changes in transmission rates are the result of closing schools or simply part of the natural course of an influenza outbreak.

Evidence of cost-effectiveness

Research results on the cost-effectiveness of school closure as a response to influenza outbreaks are also mixed. On the one hand, many studies conclude that school closure is far less cost-effective than other strategies, such as immunization. School closures often force parents to stay home to care for children, especially children in kindergarten and elementary school, with the result that they are unable to contribute to the broader economy. Absenteeism may also result in lost income, adversely affecting household economies. Further, parents who cannot afford to stay home with young children may incur the expense of paying for childcare. Because parents of school-aged children include health care professionals, school closure may adversely affect health care services as well. In other words, the costs of school closures appear to outweigh potential savings.

On the other hand, some researchers have found that the cost-effectiveness of school closures may increase

with higher transmission rates and during longer, more severe influenza pandemics. In such cases, the cost of treating many, seriously-sick influenza patients may outstrip the cost of trying to prevent the spread of influenza through school closures. Closing schools may also be more cost-effective in secondary schools, when students do not require parental or other care, or when other interventions are not available.

In a broad sense, challenges in this area of research reflect a lack of laboratory confirmed diagnoses of influenza and a lack of data to assess intangible and indirect costs to families and society. Without an accurate measure of the burden of influenza, the potential benefits of school closures cannot be fully predicted.

Evidence of harms

A small, but growing body of research suggests that school closures as a public health measure can deepen social and economic disparities. For instance, school closures have been found to disproportionately affect low-income households. Some schools provide free daily nutritional programs, which may be essential for children from disadvantaged groups with fragile financial status. School closures may also impose a greater financial burden on low-income households when parents miss work and lose income to care for children. Furthermore, some studies have found that school closures can affect educational attainment and low-income households have fewer resources for tutoring or other educational supports.

Research also suggests that school closure may contribute to the spread of

influenza within households, particularly in communities where households are generally large and multigenerational. In such cases, school closure strategies may increase exposures of older family members who are at risk of suffering serious complications that may require costly healthcare services, such as hospitalization and intensive care.

Similarly, many remote and isolated communities in northern latitudes are likely to be adversely affected by school closures because the higher prevalence of crowded households, low quality housing and poor sanitation, and predisposing health conditions encourage the transmission of influenza and increase the risk of severe outcomes.

Evidence from experience

While the research on the benefits of school closures is inconclusive, past experience provides guidance about planning for and managing influenza outbreaks and epidemics. Experience suggests that closing schools – like other public health interventions – can be more or less effective, more or less harmful, depending on how they are managed. For example, researchers found school closures in Australia during the 2009 H1N1 pandemic were difficult to implement because the public, school representatives, and other stakeholders were confused and skeptical about the need for closures, especially as it became clear that the pandemic was not as severe as anticipated. In Canada, confidence in measures to address the 2009 H1N1 pandemic was eroded when the same evidence seemed to lead to different actions and outcomes across the country.

Experience underscores the importance of building consensus among stakeholders, ensuring clarity about roles and responsibilities for implementing policy, and creating consistent messages to the public about the need for specific interventions. In the case of school closures, it is especially important to revisit policies regularly as an outbreak unfolds because the high costs and social disruption of school closures may be difficult to justify – and get compliance with – in the absence of high fatality rates.

To close or not to close, is that the question?

Currently, the best answer to the question of school closures in influenza outbreaks and pandemics is – “it depends”. It depends on the strain of influenza involved and the evolution of the outbreak. It depends on the specific context of the outbreak, particularly the socio-economic characteristics of the communities affected by both influenza and school closures. It depends on whether school and other closures are acceptable to the public and likely to be met with compliance. It depends on whether the objective of closing schools is to reduce transmission of influenza, to lessen the severity of influenza in a population, or to manage demands on the health care system. It depends on whether the potential health benefits of school closures outweigh the social and economic costs.

Much more research is needed to fill evidence gaps and reach consensus about the relative merits of school closure in influenza outbreaks and pandemics. A lack of controlled comparisons, prospective and long-term studies, and clarity on research


Making decisions on school closures depends on the availability of a variety of evidence, including:

- the dominant influenza strain
- strain severity (mild, moderate, severe)
- age-specific attack rates as an indication of which sub-populations are susceptible
- transmission rate (R_0).

And information about the local population that may heighten risks for adverse effects of closure and influenza severity, such as:

- demographic make-up (e.g. population under age 5, over age 65)
- inadequate housing (e.g. crowding)
- water and sanitation conditions
- prevalence of predisposing health conditions and risk factors (e.g. diabetes, smoking)
- social factors influencing contact patterns (e.g. mass gatherings, multi-generational households, caregiving)

Decision-makers may also consider the availability of less costly interventions and ethical strategies that improve equity.



objectives and the outcomes of interest hampers conclusive decisions. It is difficult to generalize from the available evidence as it may be based on very different school closure practices, social contexts, and outbreak circumstances than what applies in local contexts, as well as on cases of illness that may not be influenza.

Existing research suggests that in the case of school closure – as with many other public health interventions – one size will not fit all. In the absence of evidence to guide practice, public health decision-makers may determine the need to close schools on a case-by-case basis, taking circumstances of each epidemic, circumstances in the community, and other available strategies into account.

Clarity on the purpose and desired outcomes will be critical to developing predictive models and to making appropriate and effective public health decisions about closing schools.

Additional Reading:

Isfeld-Kiely, H. and S. Moghadas. 2014. Effectiveness of School Closure for the Control of Influenza: A review of recent Evidence. Winnipeg: National Collaborating Centre for Infectious Diseases

Neufeld, J. and J. Kettner. 2014. The Settings Approach in Public Health: Thinking about Schools in Infectious Disease Prevention and Control. Winnipeg: National Collaborating Centre for Infectious Diseases

This brief is based on a 2014 review of evidence prepared by NCCID. The full report including all references is available at https://www.nccid.ca/files/Influenza/SchoolClosures_ENG.pdf

This document is available in its entirety in electronic format (PDF) on the web site of the National Collaborating Centre for Infectious Diseases at www.nccid.ca.

You may be interested in other publications issued by NCCID and its partners related to the prevention and control of influenza. The collaborative Influenza and Influenza-like Illness Project is leveraging the expertise of six National Collaborating Centres on Public Health to address recognized knowledge gaps as well as the needs of public health and primary care professionals who work in influenza prevention. Documents within the series address these and other issues. Learn more about the influenza project at www.nccid.ca/influenza.

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